POST-PRANDIAL CHANGES OF UNSTRESSED AND STRESSED DORSAL AORTA CANNULATED RAINBOW TROUT (*ONCORHYNCHUS MYKISS*) FED YEASTS

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Introduction

Feeding experiments can demonstrate long-term effects of test diets on fish growth and feed digestibility, however, they cannot determine short-term effects on nutrient uptake and stress response. Blood sampling during feeding experiments requires sedation and handling that can stress and affect blood parameters of fish (Djordjevic et al., 2011). Dorsal aorta (DA) cannulation of fish allows for serial blood sampling without inflicting stress. Single cell proteins, such as yeasts, are an ideal feed alternative to plant and fish meals as they do not compete as food for humans. In addition, yeasts, such as *Saccharomyces cerevisiae*, contain beta-glucans in their cell walls that can induce an immunostimulant effect on fish that increases disease resistance (Siwicki et al., 1994). The objective of this study was to determine the post-prandial changes of unstressed and stressed DA cannulated rainbow trout fed two different yeast diets.

Materials and methods

Rainbow trout were DA cannulated according to Kiessling et al (1995) with modifications. Briefly, fish were sedated with 1mg L^{-1} metomidate, anesthetised with 80mg L-1 tricaine methane sulfonate (MS222) and then placed in a recirculating surgery bath of 60mg L-1 MS222. Lidocain was used as a local anaesthetic at the incision sites where 180 polyethylene (PE) tubing was inserted in the snout of the fish and 90 PE tubing was inserted into the DA via guide wire. The 1m long cannula was injected with heparinised saline and sealed and the fish was given 3-5 days to recover while being fed a commercial diet. In total, 15 cannulated fish that weighed 849 ± 199g (±SD) were fed three iso-nitrogenous diets: fish meal control (FM), 60% replacement of fish meal with *S. cerevisiae* (YS) and 60% replacement with a 70:30 mix of *W. anomalus* and *S. cerevisiae* (YW). Fish were fed at 1% body weight (BW) via automated feeders with collectors in 200L tanks equipped with individual water flow (15C), shadow and light. For the diet test, 5 random fish were fed each diet for 1 week and then fed a different diet for weeks 2 and 3 (cross over design). For the stress test, fish were fed for a 4^{th} week and then stressed via netting for 1min after feeding. Blood samples of 0.35mL were taken at 0 (before feeding), 3, 6, 12 and 24 hours on day 7 of every week. Blood was analysed for sodium, potassium, glucose, pH, PCO2, TCO2, HCO3, base excess and hemoglobin using an i-STAT analyser and haematocrit and leucocrit were measured after centrifugation. Red blood cells (RBC) were diluted and counted in a Burker chamber.

Results

Fish consumed diets at a rate of 0.83 ± 0.22% BW over 4 weeks. Samples from fish that consumed less than 0.20% BW were excluded from analyses. There were no mortalities, but 5 fish were replaced due to non-functioning cannulas. For the diet test, YS and YW diets were both significantly different ($P<0.05$) than FM diet for sodium, potassium, pH, TCO2, HCO3 and base excess. Hemaglobin of diet YW was different from diet FM. For the stress test, no significant differences existed between diets. In comparison, only glucose (YS and YW diets) and potassium (YW diet) were significantly different between diet and stress tests, although hematocrit and hemaglobin significantly increased and pH and blood gases significantly decreased after stress (i.e. 0 to 3 hr).

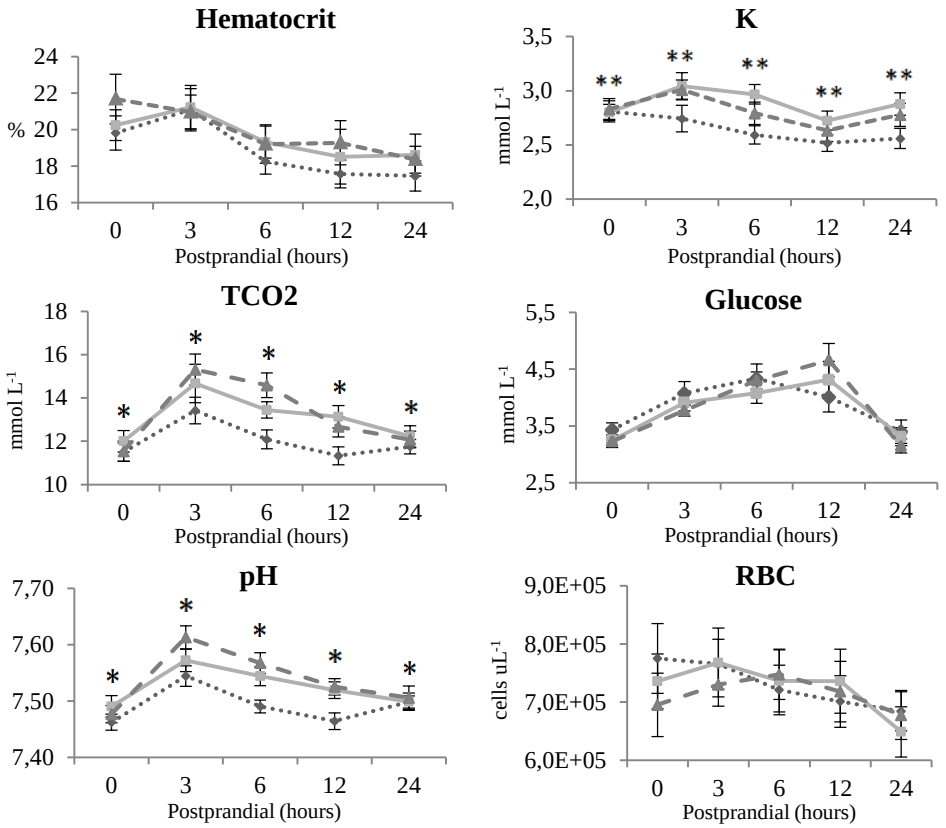

Fig. 1. Post-prandial changes in haematocrit, K, TCO2, glucose, pH and RBC for the diet test comparing FM (▲), YS (■) and YW (♦). Asterisk (*) denote significant difference ($P<0.05$) between YW and FM diets and (**) denote difference between both YS and YW diets to FM.

Discussion and conclusion

This study is one of the first to analyse blood samples from DA cannulated rainbow trout that voluntarily consumed feed after surgery. In the diet test, differences in blood potassium and sodium between diets are likely due to feed composition as yeast diets contained higher levels of potassium and lower levels of sodium compared to the FM diet. Increased levels of pH and blood gases in the yeast diets may be due to an immunostimulant effect from yeast beta-glucans (Siwicki et al., 1994), but more research is needed. In the stress test, increased levels of haematocrit, haemoglobin and glucose as well as reduced pH and blood gases have been previously reported as a result of increased catecholamine release and ventilation to cope with stress (Djordjevic et al., 2011). In conclusion, replacing fish meal with yeasts can significantly impact blood parameters of rainbow trout, however, yeasts diets had no significant effect on acute stress response.

References

Djordjevic B., T. Kristensen, Ø. Øverli, B. Rosseland, and A. Kiessling. 2011. Effect of nutritional status and sampling intensity on recovery after dorsal aorta cannulation in free-swimming Atlantic salmon. Fish Physiology and Biochemistry 38: 259–272.

Kiessling A., B. Dosanjh, D. Higgs, G. Deacon, and N. Rowshandeli. 1995. Dorsal aorta cannulation: a method to monitor changes in blood levels of astaxanthin in voluntarily feeding Atlantic salmon. Aquaculture Nutrition 1(1): 43–50.

Siwicki A., D. Anderson, and G. Rumsey. 1994. Dietary intake of immunostimulants by rainbow trout affects non-specific immunity and protection against furunculosis. Veterinary lmmunology and lmmunopathology 41: 125-139.